Silicon nanowire based biosensor for detection of organic molecules

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Silicon nanowires attract considerable attention due to their possible application in nanomedicine as ultrasensitive detectors in medicine. Schottky barrier FETs are of great interest on their own account as an alternative to traditional doped source and drain device structures, because sub-100 nm ranges scaling encounters fundamental problems including high leakage current and parasitic resistance. Silicon nanowires were fabricated from commercially available SOI (100) wafers using top-down nanofabrication approach. The probe of atomic-force microscope was used to deposit detectable molecules on nanowire surface. When a molecule is deposited on the surface of a nanowire, it acts as a virtual gate. Changes occur between the ODT molecules and the silicon surface, which were converted into an electrical signal with the help of a suitable converter. For this purpose, the organic polymer 1-octadecanethiol (ODT) dissolved in acetonitrile was deposited on the nanowire surface. This polymer CH_3-$(CH_2)_{17}$-SH covalently binds with the nanowire surface.

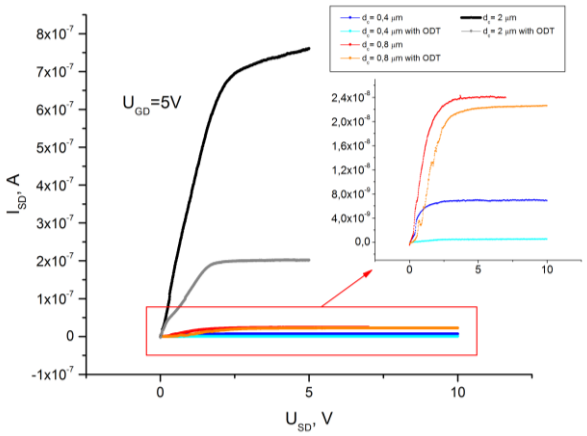

Fig.1. I_{SD}-V_{SD} characteristics for 0.4, 0.8, 2 μm nanowires

Current-voltage (I-V) characteristic between the source (S) and drain (D) contact pads before surface functionalization of silicon nanowires with ODT-molecules. The I_{SD}-V_{SD} characteristics for nanowire with 0.4, 0.8, 2 μm width are presented in Fig. 1. Current-voltage characteristics of nanowires with deposited ODT-molecules were measured under the same conditions. The electrical measurements confirmed that this top-down nanofabrication process produces high-quality silicon nanowires with great potential for further development.